"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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GINDIN, A.

Concrete operations in building the Bratsk Hydroelectric Power Station. Na stroi. Ros. no.3:5-8 D '60. (MIRA 14:6)

1. Glavnyy inzh. stroitel'stva Bratskoy gidroelektrostantsii.
(Bratsk Hydroelectric Power Station--Concrete construction)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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GINDIN, Aron Mendelevich; AZARKH, M., otv. red.; BOROZDIN, B., red. izd-va; POGODIN, Yu., red.izd-va; TELEGINA, T., tekhn. red.

[How the Bolsheviks nationalized private banks; facts and documents on the post-October days in Petrograd]Kak bol'sheviki natsionalizirovali chastnye banki; fakty i dokumenty posle-oktiabr'skikh dnei v Petrograde. Predisl. I.I.Mintsa. Moskva, Gosfinizdat, 1962. 141 p. (MIRA 16:2)

(Leningrad--Banks and banking)
(Leningrad--Revolution, 1917-1921)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"
"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A 1T46

USSR/Medicine - Blood Circulation Mar 1947
Hyperimmunized Plasma

"The Volume of Circulating Blood in Hyperimmunized Plasma Donors (Serum Horses)," A P Gindin, 3 pp

"Byul Eksper Biol I Med," Vol XXIII, No 3 (Summary)

Circulation in horses is increased by $1\frac{1}{2}$. Increase in amount of blood is conditioned by the increase in the amount of plasma.

1T46

GINDIN, A. P.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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PA 13/49T49

USSR/Medicine - Amyloidosis Jul/Aug 48
Medicine - Liver

"Problem of Localization of Intercellular Amyloids," A. P. Gindin, Path Lab, Cen Inst Epidemiol and Microbiol, 3 3/4 pp

"Arkhiv Patologii" Vol X, No 4

Reports observations on horses, with two sketches Concludes that prolonged hyperimmunization of horses with gangrenous, tetanic, diphtheric, and other antigens results in amyloidosis of the liver

13/49T49

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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SHEVELEV, A.B.; GINDIN, A.P., zaveduyushchiy; KRONTOVSKAYA, M.K., professor, zaveduyushchiy; TIMAKOV, V.D., professor, direktor.

Study of peritoneal rickettsiosis in connection with the effect of splenectomy and block upon the morphologic reaction of the organism. Zhur.mikrobiol.epid. i immun. no.9:12-16 S '53. (MLRA 6:11)

1. Sypnotifoznyy otdel Instituta epidemiologii i mikrobiologii im. pochetnogo akademika N.F.Gamalei Akademii meditsinskikh nauk SSSR (for Krontovskaya). 2. Patomorfologicheskaya laboratoriya Instituta epidemiologii i mikrobiologii im. pochetnogo akademika N.F.Gamalei Akademii meditsinskikh nauk SSSR (for Gindin). 3. Institut epidemiologii i mikrobiologii im.pochetnogo akademika N.F.Gamalei Akademii meditsinskikh nauk SSSR (for Timakov).

(Peritoneum--Diseases) (Rickettsia) (Spleen--Surgery)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; FORSHTER, Kh.K.

Pathogenesis of atypical forms of infecticus processes following antibiotic therapy; experiments with Breslau infections in mice. Zhur.mikrobiol.epid.i immun. no.5:73-76 My '55. (MLRA 8:7)

1. Iz otdela infektsionnoy patologii i eksperimental'noy terapii (zav.-prof. Kh.Kh.Planel'yes) i patogistologicheskoy laboratorii (zav.-prof. A.P.Gindin) Instituta epidemiologii i mikrobiologii imeni N.F.Gamaleii AMN SSSR (dir.-prof. G.V.Vygodchikov).

(SALMONELLA INFECTIONS, experimental,
breslau, eff. of chlorotetracycline)
(CHLORTETRACYCLINE, effects,
on exper. Salmonella breslau infect.)

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; YATSIMIRSKAYA-KRONTOVSKAYA, M.K.; ZHIV, B.V.; SALAGOVA, T.A.

Pathomorphology of local reactions to the inoculation of the typhus vaccine following sedimentation. Zhur.mikrobio.epid. i immun. no.7:69-71 Jl '55. (MLRA 8:10)

1. Iz Instituta epidemiologii i mikrobiologii imeni N.F. Gamaleĭ AMN SSSR dir. prof. G.V.Vygodchikov.
(TYPHUS, immunology,
vaccine, local reactions)
(VACCINES AND VACCINATIONS,
typhus vaccine, local reactions)

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

USSR/Medicine - Tularemia FD-3394

Card 1/1 Pub. 17-18/22

Author : Kalitina, T. A. and *Gindin, A. P.

Title : Morphological character of tularemia skin reaction

Periodical : Byul. eksp. biol. i med. 8, 66-68, Aug 1955

Abstract : Authors studied reaction to tularin (allergen used in diagnosing tularemia) using skin biopsies from 21 immune and 3 non-immune guinea pigs. Non-sensitized (non-immune) animals showed only a slight skin reaction; in immune animals, the reaction was prolonged and more severe. Histo-morphological and histo-pathological findings, effects on the organs and other tissues are described. Authors conclude that reaction following administration of the vaccine strain or of tularin was less malignant than the reaction from the virulent strain. 7 references, 7 USSR, 3 since 1940.

Institution : Tularemia Laboratory (Head: Prof N. G. Olsuf'yev) and Patho histological Lab (*Head) Inst of Epidemiology and Microbiology imeni N. F. Gamaleya (Dir. Active Mem Acad Med Sci USSR Prof G. V. Vygodchikov) Acad Med Sci USSR, Moscow

Submitted : 18 Jan 1955

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
GINDIN, A. R.
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

"Concerning the Pathogenesis of Atypical Forms of Infectious Processes Arising After Treatment With Antibiotics." Proceeding of Inst. Epidem Microbiol im. Gamaleya 1954-56.

Laboratory of Microbiology, Timakov, V. D., professor, Active Member, Academy of Medical Sciences USSR, head, Inst. Epidem and Microbiol.im. Gamaleya AMS USSR

SO: Sum 1186, 11 Jan 57.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A. P., and KALITINA, T. A.

"Morphological Characteristics of the Cutaneous Tularemia Reaction" [Note: Kalitina, T. A., has been associated also with the Tularemia Laboratory.] Proceedings of Inst. Epidem and Microbiol im. Gamaleya 1954-56.

Laboratory of Microbiology, Timakov, V. D., professor, Active Member, Academy of Medical Sciences USSR, head, Inst. Epidem and Microbiol im. Gamaleya AMS USSR.

SO: Sum 1186, 11 Jan 57.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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USSR/Human and Animal Physiology - (Normal and Pathological). Blood. Blood Diseases. T-4

Abs Jour : Ref Zhur - Biol., No 11, 1958, 50742

Author : Gindin, A.P., Ogiyenko, N.M., Lyutikova, O.G., Statkevich, I.A.

Inst : -

Title : The Siderocytes of the Peripheral Blood in Viral Anemia.

Orig Pub : Byul. experim. biol. i meditsiny, 1956, 42, No 9, 20-21.

Abstract : Syderocytes (which are macrocytes containing hemosiderin) were not found in the blood of 30 normally kept healthy horses, nor were they found in the blood of another 26 healthy horses (producers of therapeutic sera), who were tested after they had given the usual blood donation. In the majority of the cases, siderocytes were found in the blood of horses suffering from infectious anemia, a fact which proves that a disturbance of Fe metabolism exists. The appearance of hemosiderin containing erythrocytes

Card 1/2 Pathomorphology Lab. Inst. Epidemiology, Microbiology im. N.F. Gamaleya AMS USSR

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GINDIN, A.P., OGIYENKO, N.M.

Ribonucleic acid in cells of peripheral blood [with summary in English]. Biul. eksp.biol. i med. 46 no.8:62-64 Ag '58 (MIRA 11:10)

1. Iz Instituta epidemiologii i mikrobiologii imeni N.F. Gamalei (dir. prof. S.N. Muromtsev) AMN SSSR, Moskva. Predstavlena deystvitel'nym chlenom AMN SSSR G.V. Vygodchikovym.

(NUCLEIC ACID, in blood
in cells of peripheral blood of horses (Rus))
(BLOOD CELLS, metab.
ribonucleic acid in cells of peripheral blood of horses (Rus))
(BLOOD CELLS, metab.
ribonucleic acid in cells of peripheral blood of horses (Rus))

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; OGIYENKO, N.M.

Lymphocytic ribonucleic acid in the peripheral blood during intense antitoxic imminogenesis. Zhur.mikrobiol.epid. i immun. 30 no.2:94-98 F '59. (MIRA 12:3)

1. Iz Instituta epidemiologii i mikrobiologii imeni Gamalei AMN SSSR.
(RIBONUCLEIC ACID, in blood,
lymphocytes, during immunogenesis (Rus))
(VACCINES AND VACCINATION,
ribonucleic acid in lymphocytes during immunogenesis (Rus))

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MUROMTSEV, S. N. [deceased]; GINDIN, A. P.; ANOSOV, I. Ya.; MAYOROVA, G. F.; BORODIYUK, N. A.

Morphological characteristics of the reaction of the body to inhalation immunization with bacterial antigens. Report No. 1: Morphological characteristics of pulmonary reactions to inhalation revaccination with diphtheria antitoxin and whooping cough vaccine. Zhur. mikrobiol., epid. i immun. 32 no.8:7-12 Ag '61. (MIRA 15:7)

1. Iz Instituta epidemiologii i mikrobiologii imeni Gamalei AMN SSSR.

(DIPHTHERIA) (WHOOPING COUGH) (LUNGS)
(IMMUNITY)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; OGIYENKO, N.M.; USHAKOVA, A.V.

Ribonucleic acid in the blood lymphocytes in adrenaline lymphocytosis. Biul. eksp. biol. i med. 54 no.9:62-64 S. '62. (MIRA 17:9)

1. Iz Instituta epidemiologii i mikrobiologii imeni N.F. Gamalei (dir.- prof. P.A. Vershilova) AMN SSSR, Moskva. Predstavleno deystvitel'nym chlenom AMN SSSR. G.V. Vygodchikovym.

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; OGIYENKO, N.M.

Ribonucleic acid in the blood lymphocytes of rabbits.
Tsitologiia 4 no.6:689-691 N-D'62 (MIRA 17:3)

1. Patomorfologicheskaya laboratoriya Instituta epidemiologii i mikrobiologii AMN SSSR, Moskva.

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[illegible]

[illegible] "[illegible]" [illegible] laboratory [illegible] of [illegible] [illegible] in [illegible] [illegible] [illegible] '63.
(MIRA 18:8)

1. [illegible] AN SSSR.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, A.P.; ANOSOV, I.Ya.; MAYOROVA, G.F.

Histopathology and histochemistry of the reaction of lymphoid organs to inhalation immunization with pertussis vaccine. Zhur. mikrobiol., epid. i immun. 40 no.3:45-49 Mr '63. (MIRA 17:2)

1. Iz Instituta epidemiologii i mikrobiologii imeni Gamalei AMN SSSR.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

S/133/63/000/004/005/011
A054/A126

AUTHORS: Meandrov, L. V., Golovanenko, S. A., Bykov, A. A., Myagkov, A. P., Korotkevich, B. M., Borisov, A. N., Kossovskiy, L. D., Gindin, A.Sh.

TITLE: Experimental rolling of bimetal sheets

PERIODICAL: Stal', no. 4, 1963, 343 - 346

TEXT: Tests were carried out at the Chelyabinskiy metallurgicheskiy zavod (Chelyabinsk Metallurgical Plant) with the participation of N. P. Shohukin, V. D. Nikitin, S. A. Zuyev, V. P. Nikitin, N. N. Danilovich, N. V. Zerchaninov, V. V. Shturts, V. A. Ustimenko, V. V. Silant'yev, to establish the technology of bimetal sheet production. Symmetric (4-layer, 150 - 220 mm thick) and asummetrical (3-layer, 135 mm thick) sheets were produced. The nickel coating was applied in some tests by the standard electrolytic method, in some tests, however, a new process was employed with a special apparatus, involving the melting of a 1.5-mm diameter nickel wire, which was thereupon applied to the sheet surface by pulverization. Prior to this the surface to be coated was shot-blasted. A 600 x x 1,750 mm sheet could be coated by this process with a 40 μ thick nickel layer

Card 1/2

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Experimental rolling of bimetal sheets

S/133/63/000/004/005/011
A054/A126

in 20 minutes. The new method proved more advantageous than the conventional one: it required less time and no pickling. The pulverizing apparatus is simple, inexpensive and easily adjustable to automation. After coating the bimetal sheets were welded air-tight on the perimeter and the end surfaces. The rolling tests were made on a 2,300-mm stand at Chelyabinsk by the standard method. The welding seams prevented warping and lamination of the bimetal sheets. The tightness and the strength of the seams depended on the surface quality of the stainless and carbon steels composing the sheet and on the assembly and welding of the sheet layers. The deformation of the various layers in rolling was not uniform. This deviation in deformation was characterized by an experimental coefficient that in case of 4 - 10 mm thick sheets depended in the first place on the metal grade of the coating layer, but was independent of the total reduction in the investigated range of deformations. For sheets of Ст.3сп/St.3sp + Х 18 Н10Т / Kh18N10T grades the average coefficient value was 0.94 - 0.96, for sheets of St.3sp + 1Х 13/1Kh13 steel grades: 1.03 - 1.05. There are 4 figures and 1 table.

ASSOCIATION: TsNIIChM, Chelyabinskiy NIIM (Chelyabinsk NIIM, ChMZ)

Card 2/2

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GLADKOVSKIY, V.A.; GINDIN, A.Sh.; KOSSOVSKIY, L.D.; POPOV, N.P.

Evaluation of the magnitude of residual stresses in surface layers of a back-up roll. Zav. lab. 29 no.9:1128-1129 '63. (MIRA 17:1)

1. Permskiy politekhnicheskiy institut.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

IZRAILEVICH, M.L.; GINDIN, B.Ya.; LAZDAN, E.Ye.

Soot conveyors for rubber tire plants. Biul. tekh.-ekon. inform. Gos. nauch.-issl. inst. nauch. i tekh. inform. 17 no.2: 14-17 '64. (MIRA 17:6)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, B. Ya.

Introducing a small closed scraper conveyor with a cooled bottom. Biul. tekh.-ekon. inform. Gos. nauch.-issl. inst. nauch. i tekh. inform. 18 no. 12:56-58 D '65 (MIRA 19:1)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, D.A.

Medical electric humidity meters. Med.prom. 15 no.9:56-59 S '61. (MIRA14:9)

1. Mediko-instrumental'nyy zavod "Krasnogvardeyets".
(WATER IN THE BODY) (PHYSIOLOGICAL APPARATUS)

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S/582/61/000/005/005/012
D222/D306

AUTHOR: Gindin, D. G. (Moscow)

TITLE: On the control of chemical reactions

SOURCE: Problemy kibernetiki, no. 5, Moscow, 1961, 97-103

TEXT: This paper is a general discussion of some ideas that may be relevant to the automation of processes in the chemical industry. The basic ideas of this paper were reported and discussed at a seminar at the Vsesoyuznyy institut aviatsionnykh materialov (All-Union Institute of Aviation Materials) in 1946, under the leadership of Ya. I. Frenkel', now corresponding member of the Academy of Sciences USSR. The author argues that there is a need to establish a branch within cybernetics to deal with the specific problems arising in chemistry. The main purpose of "chemical cybernetics" would be to construct devices for the automatic control of chemical processes, using sensing elements and information processing units. At present, however, the most important problem is the algorithmization of chemical processes, i.e. the construction

Card 1/3

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of logical schemes for the kinetic, technological and other properties, and the construction of "chemical" algorithms. Two kinds of factors are distinguished that can influence the course of the processes: Internal (those which originate in the physico-chemical properties of the reacting substances), and external (those originating in the environment of the reaction, i.e. temperature, etc.). The author concentrates on the internal factors. It is suggested that the dispersion of results, observed even with seemingly rigorously controlled uniform conditions, is due to the fact that the experimental specimens have a kind of individual nature due to the complexity of their physico-chemical structure. Small fluctuations in these properties can give rise to either a convergent or divergent tendency in the results. Examples of processes where such an individual nature of specimens is found are the corrosion of metals, electrochemistry, chemical kinetics, semiconductors, strength of materials, and so on. There are 8 references: 2 Soviet-bloc and 6 non-Soviet-bloc. The references to the English-language publications read as follows: N. Wiener, Cybernetics, 1958; W. R. Ashby, Introduction to Cybernetics, 1959.

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GINDIN, D.Ye., inzh.

Increasing the speed and reliability of feed mechanisms.
Mekh. i avtom. proizv. 19 no. 10:13-15 O '65. (MIRA 18:12)

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1"

GAPCHENKO, P., invalid Otechestvennoy voyny (g. Kiyev); GINDIN, G., invalid Otechestvennoy voyny (g. Kiyev); SAVINSKIY, A., invalid Otechestvennoy voyny (g. Kiyev); KOLODOCHKA, B., invalid Otechestvennoy voyny (g. Kiyev); KHOVANSKIY, A., invalid Otechestvennoy voyny (g. Kiyev).

Bring order into the organization of motor wheelchair repair. Prom.koop. no.6:24 Je '57. (MLRA 10:7)
(Orthopedic apparatus)

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5.(1. 2 Rub. & Allied Products

Mechanism of the simultaneous polymerisation of butadiene with vinyl cyanide and 1-methylvinyl cyanide under the action of benzoyl peroxide. I. Gvozdev, A. Vasiliev, and [illegible] Mikhailov (J. Phys. Chem. U.S.S.R., 1947, 21, 1269-80; Chem. Abs., 1948, 42, 8715). Mixtures of butadiene with vinyl cyanide or 1-methyl vinyl cyanide and benzoyl peroxide were prepared in nitrogen, heated, and distilled in high vacuum (20 μ). The distillation residue, which is the polymer, was analysed for nitrogen and active oxygen. With vinyl cyanide the rate of polymer formation decreases as the ratio of butadiene increases at 60°. During one experiment rate of formation was almost constant for small butadiene percentage and increases with time at large percentage. Rate of polymer formation increases with temperature. The rate is proportional to the square root of the % of benzoyl peroxide between 0.3 and 10 wt. %. The highest yield of polymer over 93% was observed when % butadiene was 50. In the case of the 1-methylvinyl cyanide the highest yield was obtained when butadiene content was 70%. The concentration of benzoyl peroxide decreases in the polymer as temperature increases, but polymerisation continues after this is zero. Monomer distilled from polymer and mixed with it again polymerises at same rate as before, but solution and reprecipitation of the polymer removes its catalytic activity. In the butadiene vinyl cyanide polymer 67% of vinyl cyanide is present as one nitrile group between two butadiene groups. In the other polymer the 1-methyl vinyl cyanide group is in a similar position.

3S2MDN21 12212

1948

GINDIN, I. A.
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000513110016-1
APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000513110016-1

USSR/Metals - Bismuth Aug 50
Twinning

"Twinning in Bismuth," I. A. Gindin, V. I. Startsev, Physicotech Inst, Acad Sci Ukrainian SSR

"Zhur Eksper i Teoret Fiz" Vol XX, No 8, pp 738-741

Describes process of formation and propagation of twinned layers in monocrystallic bismuth under action of concentrated loads. Observes similarity of twinning processes in metallic and ionic monocrystals. Shows presence of two yield points in twinning of bismuth monocrystals. Studies influence

[redacted] 165T34

USSR/Metals - Bismuth (Contd) Aug 50

of annealing upon state of twinned layers. Show retrogressive twinning occurs in bismuth. Submitted 9 Feb 50.

[redacted] 165T34

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USSR

Annealing twinned crystals of iron. R. I. Garber, I. A. Gindin, V. G. Kononenko, and V. I. Startsev (Fiziko-Tekh. Inst., Akad. Nauk Ukr. S.S.R., Kharkov). *Doklady Akad. Nauk S.S.S.R.* 94, 1-4 (1954).—Specimens of Cu [illegible] were annealed for 1 hr. at 600° for 1 hr., elongated 2-3%, then annealed 1 hr. at increasing temp. gradually from 600 to 800° in steps of 1 hr. each and 0.1-0.3 mm. The specimens were then heated under tension at temp. of liquid N_2 until twinned crystals in grains near the fractures. Twinning layers began to disappear after 10 hrs. annealing at 800°, and all had disappeared after 55 hrs. at 870° followed by 50 hrs. at 900°. H. W. Rathmann

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GINDIN, I. A.

USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds, E-9

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34862

Author: Garber, R. I., Gindin, I. A., Kogan, V. S., Lazarev, B. G.

Institution: None

Title: Investigation of Plastic Properties of Beryllium Monocrystals

Original Periodical: Fiz. metallov i metallovedeniye, 1955, 1, No 3, 529-537

Abstract: transition of the Be monocrystal into a fully-twinned state is related to the process of mechanical twinning in the (102) plane, and is particularly easy to effect at 400° and above. In addition to the principal system of twins along (102), one observes also twins in the (101) and (103) planes. The mechanism of slipping of Be depends substantially on the temperature and orientation of the specimen. In some specimens, base slipping is observed even at -196°. The plasticity of Be, which increases monotonically with temperature, reaches a maximum at 400° (δ = 26%) and diminishes somewhat at 600°, and increases again at 800°. The mechanical characteristics of the plasticity of monocrystals of beryllium are determined, and their dependence on temperature. The yield point when slipping along the (100) and (101) planes diminishes by approximately 4 times when heated from 200 to 800°.

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GINDIN, I.A.

E-9

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Crystalline Compounds

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6787

Author : Gerber, R.I., Gindin, I.A., Kogan, V.S., Lazarev, B.G.
Inst : Physico-Technical Institute, Academy of Sciences, Ukraine SSR
Title : X-ray Investigation of the Plasticity of Single Crystals of Beryllium

Orig Pub : Izv. AN SSSR, ser, fiz., 1956, 20, No 6, 639-640

Abstract : X-ray diffraction, metallography and micro-interferometry have been used to investigate single crystals of beryllium, cut in the form of rectangular parallelepipeds, with one of the faces aligned with the plane of the base. The specimens were deformed by unilateral compression at temperatures from -253 to 800°. The results of the investigations are summarized in a table.

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GINDIN, I.A.

CARD 1 / 2 PA - 1479

SUBJECT USSR / PHYSICS
AUTHOR GARBER, R.I., GINDIN, I.A., KOGAN, V.S., LAZAREV, B.G.
TITLE The Recrystallization of Metals at Low Temperatures.
PERIODICAL Dokl. Akad. Nauk, 110, fasc. 1, 64-66 (1956)
Issued: 11 / 1956 reviewed: 11 / 1956

This work deals with the direct observation of the microstructure of technical iron (0,03% C) and nickel deformed at the temperature of liquid nitrogen. The examination of iron and nickel makes it possible to explain the influence exercised by the principal forms of plastic deformation, namely of twin-formation(?) and creeping on the creation of inhomogeneities of the crystal lattice caused by deformation and on the occasion of processes of recrystallization which are due to these inhomogeneities. Fine- and rough-grained samples with 25-30 μ and 100 - 200 μ diameter were examined. Deformation was brought about either by rolling or by pressing a hardened ball through an immobile thin-walled tube in liquid nitrogen. The degree of deformation was between 5 and 14%. The X-ray structure analysis was carried out: a) in the initial state, b) immediately after the deformation in liquid nitrogen without heating up to room temperatures, c) after a 10 to 12 hours' stay period at room temperature. Parallel with X-ray investigation a metallographical investigation of the samples was carried out. In the case of the iron and nickel deformed in liquid nitrogen the structure was refined by recrystallization after heating up to 20°. A microphotograph of the structure is attached. While the ball is pressed through the tube (in liquid nitrogen) a deformation structure is produced in the sample which is destroyed

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by subsequent heating up to room temperature. A similar structural change is found in iron samples after rolling in liquid nitrogen, but in this case the degree of refinement is higher than on the occasion of pressing the ball through the tube. The degree of refinement in iron and nickel after treatment at low temperatures followed by heating to 20° depends on the size of grain of the initial structure as well as on the degree of deformation. For the production of microdistortions the initial stages of deformation are of importance at low temperatures, on which occasion the work performed by exterior forces goes over nearly entirely into the latent deformation energy. On the occasion of deformation (beginning with an 8% deformation) as a result of pressing a ball through a tube micropores are produced, a process which may be connected with mechanical twin formation. In all the cases of recrystallization at low temperatures investigated on this occasion, deformation was brought about by the formation of creeping stripes either in a pure form (nickel) or in connection with twin formation (iron).

INSTITUTION: Physical-Technical Institute of the Academy of Science in the USSR.

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GINDIN, I. A.

126-2-17/35

AUTHORS: Gindin, I. A., and Kogan, V. S.

TITLE: State of the surface layer of a single zinc crystal after grinding and annealing. (Sostoyaniye poverkhnostnogo sloya monokristalla tsinka posle shlifovki i otzhiga).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 326-330 (USSR)

ABSTRACT: In earlier work of the authors (Ref.3), it was found that work hardening caused by grinding activates diffusion processes which then may become very intensive even at room temperature. It was, therefore, considered of interest to machine such specimens and make X-ray exposures of these under conditions such that these processes are either completely eliminated or at least appreciably reduced. For that purpose zinc monocrystals were ground along their cleavage planes at the temperature of liquid nitrogen (-196°C) and X-ray patterns taken directly after grinding, prior to heating them to room temperature and after "annealing" at room temperature and at 100, 150 and 200°C. Comparison of the structure of the surface layer of zinc specimens ground at -196°C with those ground at room temperature enabled elucidation of the influence of the mechanical properties on the processes taking place

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State of the surface layer of a single zinc crystal after grinding and annealing.

in the specimen during grinding. As a result of annealing of the specimens, certain details were detected in the state of the lattice of the surface layer of the specimens after grinding, which were not detected in previous experiments, during which the specimens were work hardened and subsequently investigated at room temperature without any heat treatment. It was found that the surface layer of the monocrystal breaks up into fine grains which are disorientated more strongly in specimens for which the work hardening was effected at the liquid nitrogen temperature. The annealing does not re-establish the monocrystal nature in the surface layer and leads to recrystallization with grain growth towards the depth of the monocrystal. Under the recrystallized zone there is a layer in which the monocrystal consists of blocks with orientations approaching the initial orientation and the depth of these layers increases with the annealing temperature. In crystals deformed at the temperature of liquid nitrogen and annealed at 200°C, the non-distorted monocrystal was detected only after etching to a depth of 300μ. In crystals deformed at room temperature and

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126-2-17/35

State of the surface layer of a single zinc crystal after grinding and annealing.

subsequently annealed, the depth of the distorted zones was greater still. X-ray patterns and micro-photographs are included.
There are 4 figures and 7 references, 5 of which are Slavic.

SUBMITTED: April 16, 1956 (Initially), December 18, 1956 (after revision).

ASSOCIATION: Physico-Technical Institute Ac. Sc. Ukrainian SSR. (Fiziko-Tekhnicheskiy Institut AN USSR).

AVAILABLE: Library of Congress.

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GARBER, R. I., GINDIN, I. A and POLYAKOV, L. M.

"Fractioning and Sintering of Microblocks during the Plastical Deformation of Crystals."

paper presented at the Conf. on Mechanical Properties of Non-Metallic Solids, Leningrad, USSR, 19-26 May 58.

Physical-Technical Institute of the Ukrainian Academy of Sciences, Kharkov.

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SOV/126---7-5-25/25

AUTHORS: Gindin, I. A., Khotkevich, V. I. and Starodubov, Ya. D.

TITLE: Investigation of the Plastic Properties of Aluminium at Low Temperatures (Issledovaniye plasticheskikh svoystv alyuminiya pri nizkikh temperaturakh)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 5, pp 794-800 (USSR) 1958

ABSTRACT: Pure aluminium (99.994% Al) and technical aluminium containing up to 1% impurities (Si, Mn, Fe) were used for the investigation. The specimens were in the shape of plates of 2.5 x 2.5 mm cross-section and 17 mm working length, widening at the ends for ease of gripping in the testing machine. After grinding and polishing, all specimens were annealed in vacuum for one hour at 300°C. The average linear grain size in pure aluminium was 1.0 to 1.5 mm, and in technical aluminium 0.3 to 0.5 mm. Deformation was carried out in a vertical-type tensile testing machine using mechanical loading, being specially adapted for low temperature work. Tensile tests were carried out at 293, 77, 20, 4.2, 2.06 and 1.4°K. In this apparatus it was possible to carry out tensile and compression tests in liquid hydrogen as well as

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SOV/126---7-5-25/25

Investigation of the Plastic Properties of Aluminium at Low Temperatures.

in liquid helium at 4.2°K and below. A temperature of less than 4.2°K was obtained by evacuating helium. The layout of the apparatus is shown in Fig.1. A study of the macro- and microstructure of fractured specimens has shown that the nature of plastic deformation of aluminium changes fundamentally with change in temperature from 20 - 4.2°K and below. Fig.2 shows the microstructure of an aluminium specimen (99.994%), fractured at 20°K. Fig.3 shows the microstructure of a similar specimen fractured at 4.2°K. In Fig.4 the macrostructure of aluminium specimens (99.994% Al) fractured at 20°K (a) and 4.2°K (b) is shown. In Fig.5 load-extension curves for cylindrical specimens of technically pure aluminium of 3 mm diameter (annealed at 300°C for one hour, grain size 0.3 mm) are shown for various temperatures. In Fig.6 load-extension curves for flat pure aluminium specimens of 2.5 x 2.5 mm section (annealed at 300°C for one hour, grain size 1-1.5 mm) are shown for various temperatures. Fig.7 shows load-extension curves for specimens of technically pure aluminium at 4.2°K after various preliminary treatments. In Fig.8 a micro-interference picture of the polished surface of a pure aluminium specimen, deformed at 1.4°K, is shown.

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Investigation of the Plastic Properties of Aluminium at Low Temperatures

Fig.9 is a photomicrograph of the polished surface of a pure aluminium specimen deformed at 1.4°K. The deflection of a scratch at the boundary of large blocks is visible. Fig.10 shows the deflection of interference lines at the boundary of large blocks of a pure aluminium specimen deformed at 1.4°K. In Fig.11 the dependence of the mechanical properties of aluminium on temperature in the range 1.4 to 293°K is shown. The authors arrive at the following conclusions:

1. It has been found that a sharp difference exists in the macro- and microscopic nature of plastic deformations of specimens of pure aluminium if the temperature at which they are strained is changed from 20 to 4.2°K and below. A lowering in the temperature of testing leads to an intensification of the inhomogeneity of plastic deformation; i.e. to the formation of large blocks the sizes of which exceed those of the average metal grain.

2. The plastic deformation of aluminium at 4.2°K and below is characterized by an unstable flow which is expressed the more clearly, the lower the testing temperature. Preliminary cold working of the specimens intensified the interrupted

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Investigation of the Plastic Properties of Aluminium at Low Temperatures

nature of flow.

3. At 4.2°K and below the formation of mechanical twins is observed in aluminium. It is possible that the instability of plastic flow is associated with the formation of mechanical twins.

4. The mechanical properties of aluminium in the temperature range 77-1.4°K have been determined. It has been found that the true strength of specimens of pure and technical aluminium tested to fracture at 4.2°K are close to one another. The ultimate tensile stress σ_s is practically independent of temperature. The residual elongation has a maximum in the range 20 to 4.2°K.

There are 11 figures and 9 references, of which 6 are Soviet and 3 English.

ASSOCIATION: Khar'kovskiy fiziko-tekhnicheskiy institut AN USSR (Khar'kov Physico-Technical Institute AS Ukr.SSR)

SUBMITTED: March 12, 1958

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18(0)

AUTHORS: Gindin, I. A., Lazarev, B. G., Starodubov, Ya. D., Khotkevich, V. I.

SOV/56-35-3-46/61

TITLE: The Low-Temperature Polymorphism of Metals (Nizkotemperaturnyy polimorfizm metallov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 3, pp 802 - 804 (USSR)

ABSTRACT: In the present paper (unlike the practice adopted by several earlier papers dealing with the same subject) the method of mechanical tests is used, in which the compression diagram of lithium, sodium, cesium, bismuth, and beryllium samples with subsequent heating are investigated. Also the variations of volume in inverse transformation are recorded. These tests were carried out on a one-ton machine with a rigid dynamometer, which is suited for carrying out measurements at helium temperatures. The velocity of deformation was constant and amounted to 0,03 mm/sec. A graph gives a typical diagram of the deformation in the coordinates "stress - absolute compression" for lithium. At 77°K this is the melting curve with consolidation of the shape at high degrees of deformation. There are no singular points indicating a

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transformation. If the deformation temperature drops to 20°K and less (down to 1,4°K), a characteristic discontinuity is observed on the curve with a sharp decrease of resistivity against deformation. The most direct proof of the polymorphous transformation in the tests discussed are the variations of volume in inverse transition while the deformed sample is being heated. Similar curves were obtained also for sodium. In the case of cesium no polymorphous transformation is observed on the deformation diagram even at 1,4°K. Nevertheless, the shape of the curve of heating allows us to conclude that, to a small extent, such a transformation actually exists. This behavior of the three alkali metals is apparently connected with the reduction of characteristic temperature and leads to the conclusion that polymorphism exists in the entire group of alkali metals. The discontinuity of stress in the compression diagram is observed also in the case of beryllium at temperatures of 4,2°K and less. All this seems to indicate an extensive occurrence of low-temperature polymorphism, which is observed in the case of tin, sodium, lithium, cesium, bismuth, and beryllium. There are 2 figures and 6 references, 4 of which are Soviet.

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The Low-Temperature Polymorphism of Metals SOV/56-35-3-46/61

ASSOCIATION: Fiziko-teknicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: June 7, 1958

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GINDIN, I. A.

24(6) PHASE I BOOK EXPLOITATION SOV/2305

Akademiya nauk SSSR

Nekotoryye problemy prochnosti tverdogo tela: sbornik statey (Some Problems in the Strength of Solids; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 386 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V. I. Aver'yanov; Tech. Ed.: R. S. Fevrner; Editorial Board: A.F. Ioffe, Academician; G. V. Kurdyumov, Academician; S. N. Zhurkov, Corresponding Member, USSR Academy of Sciences; S. P. Konstantinov, Corresponding Member, USSR Academy of Sciences; F. F. Vitman, Doctor of Physical and Mathematical Sciences, Professor (Resp. Ed.); L. A. Glikman, Doctor of Technical Sciences, Professor; N. A. Klatin, Doctor of Physical and Mathematical Sciences; V. A. Stepanov, Doctor of Technical Sciences; Ya.B. Fridman, Doctor of Technical Sciences, Professor; E. S. Ioffe, Candidate of Technical Sciences (Deputy Resp. Ed.).

PURPOSE: This book is intended for construction engineers, technologists, physicists and other persons interested in the strength of materials.

COVERAGE: This collection of articles was compiled by the Otdeleniye fiziko-matematicheskikh nauk AN SSSR (Department of Physical and Mathematical Sciences) and the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Applied Physics, Academy of Sciences, USSR) in commemoration of the 50th birthday of Nikolay Nikolayevich Davidenkov, Member of the Ukrainian Academy of Sciences, founder and head of the Otdel prochnosti materialov (Department of the Strength of Materials) at the Institute of Applied Physics, Academy of Sciences, USSR, founder of the Fakul'tet fizicheskogo metallovedeniya (Department of Physical Metallurgy) at the Leningradskiy politekhnicheskiy institut (Leningrad Polytechnic Institute), recipient of the Stalin Prize (1943), the Order of the Red Banner of Labor (1945) and the Order of Lenin (1953). The articles deal with the strength of materials, phenomena of imperfect elasticity, temper brittleness, hydrogen embrittlement, cold brittleness, influence of deformation speed on the mechanical properties of materials, fatigue of metals, and general problems of the strength, plasticity, and mechanical properties of nonmetals. Numerous personalities are mentioned in the introductory profile of Professor Davidenkov. References are given at the end of each article.

Gindin, I.A., B.G. Lazarev, Ya.D. Starodubov, and V.I. Khotkevich (Fiziko-tekhnicheskiy institut AN USSR-Institute of Applied Physics, Academy of Sciences Ukr. SSR, Khar'kov). Low-temperature Polymorphism of Metals 61

Zhurkov, S.N., and E.Ye. Tomashevskiy (Institute of Applied Physics, Academy of Sciences, USSR, Leningrad). Time Dependency of Strength Under Different Load Conditions 66

Bokshteyn, S.Z., T.I. Gudkova, A.A. Zhukhovitskiy, and S.T. Kishkin. Influence of Stresses and Deformation on the Process of Diffusion 76

Pines, B.Ya., and A.F. Siranko (Gosudarstvennyy universitet imeni Gor'kogo, g. Khar'kov State University imeni Gor'kiy, Khar'kov). Diffusion Creep of Cermet Specimens Pressed From Powdered Iron 87

Syutkina, V.I., and E.S. Yakovleva (Institut fiziki metallov UFAN SSSR, Sverdlovsk-Institute of Metal Physics, Ural Branch, Academy of Sciences, USSR, Sverdlovsk). Influence of Aluminum and Copper on the Deformation of Nickel 95

Kostorova, T.A. (Institut poluprovodnikov AN SSSR, Leningrad-Semiconductor Institute, Academy of Sciences, USSR, Leningrad). Relationship Between the Mechanical and Thermal Characteristics of Crystals

Garber, R.I., and I.I. Bolosbenko (Gosudarstvennyy pedagogicheskiy institut imeni G.S. Skovorody, Khar'kov-State Pedagogical Institute imeni G.S. Skovorda, Khar'kov). Strengthening of Rock Salt Crystals by Repeated Reverse Bending 105

Gaydukov, M.G., and V.A. Pavlov (Institute for Metal Physics, Ural Branch, Academy of Sciences, USSR, Sverdlovsk). Some Aspects of Stress Relaxation in Bronze $BK_{1.5}Z$-1 111

Tsobkallo, S.O., and Z.A. Vashchenko (Polytechnic Institute imeni M.I. Kalinin, Leningrad). Increasing the Elastic Limit and Decreasing the Elastic Aftereffect During Cold Hardening and Tempering of Spring Aluminum Bronze BrA7 118

Glikman, L.A., and E.N. Kolgatin (NII po pererabotke nefti i polucheniyu iskusstvennogo zhidkogo topliva, g. Leningrad-Scientific Research Institute for Petroleum Refining and Production of Synthetic Liquid Fuels, Leningrad). Nature of the Physical Yield Point of Steel 130

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GINDIN, I.A.; STARODUBOV, Ya.D.

Low temperature plastic breakdown of large-grain iron. Fiz.tver. tela 1 no.12:1794-1800 D '59. (MIRA 13:5)

1. Fiziko-tekhnicheskiy institut AN USSR, Khar'kov.
(Iron--Metallography)
(Deformations (Mechanics))

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GARBER, R.I.; GINDIN, I.A.; STARODUBOV, Ya.D.

Thermal hardening of twinned layers of iron crystals. Fiz.tver. tela 1 no.12:1801-1805 D '59. (MIRA 13:5)

1. Fiziko-tekhnicheskiy institut AN USSR, Khar'kov.
(Iron--Heat treatment)

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SOV/126-8-1-18/25

AUTHORS: Garber, R. I., Gindin, I. A., Kovalev, A.I. and Shubin, Yu. V.

TITLE: Study of the Plastic Properties of Monocrystals of Beryllium. II.

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 1, pp 130-139 (USSR)

ABSTRACT: In the present paper slip processes in monocrystals of beryllium which have not been submitted to preliminary twinning have been studied and the relationship between slip and fracture of beryllium in the white temperature range has been established. Specimens were made from monocrystals of a beryllium block grown by slow cooling of the melt in vacuum. The purity of the original material was 99.7%. Cutting of the block was carried out by an electro-corundum disk on a grinding machine. The worked layer was removed by etching the beryllium with an aqueous solution of hydrofluoric acid. The specimens had the shape of a rectangular prism, 3.5 x 4.0 x 7.0 mm. All prism facets were ground. Two side faces (3.5 x 7.0 mm - type-a face and 4.0 x 7.0 mm - type-b face) were polished. From the Lauegrams it was evident that the crystals were undistorted. The experi-

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Study of the Plastic Properties of Monocrystals of Beryllium. II.

ments were carried out under conditions of compressive deformation on a special press (Ref 6) at a constant deformation rate (0.03 mm/sec) at temperatures of -253, -196, 20, 400, 600 and 800°C. The specimens were orientated in such a way that the basal plane (0001) made an angle of 45 ± 1.5° with the axis of the compressive forces (Fig 1). The side face of the specimen was parallel with the crystallographic plane of the primary prism (1100) and subsequently also parallel to the primary diagonal [1120]. The metallographic and X-ray methods used for the studies have been described earlier by Garber et al. (Refs 1,7). Indexing of the exposed elements of plasticity and fracture was carried out according to the traces of deformed bands and cracks on previously polished specimen faces. The results were plotted on a standard stereographic projection of the basis plane of the crystal. An X-ray analysis method was used for the orientation of specimens and for the supplementary control of elements of slip and fracture. The structure of the bands of basal slip was studied also electronmicroscopically. In Fig 2 traces of slip occurring in monocrystals of beryllium at

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various temperatures are shown schematically. Photomicrographs of the surface of specimen faces after compression at 20°C are shown in Fig 3a and b and the micro-interference picture of the relief of these surfaces in Fig 3b and 2. The slip bands have been resolved electronmicroscopically as slip packets. At -196 and +20°C the thickness of the packet is the same, namely 0.1-0.3 μ (Fig 4). The magnitude of slip can be estimated from the displacement of a scratch intersecting the trace of the slip band in a type-b face (Fig 5). In Fig 6 compression curves for monocrystals of beryllium (curves for various slip temperatures along the abscissae axis) are shown. 1 mm along the abscissae axis corresponds to 60 μ deformation; 1 mm along the ordinate axis corresponds to a load of 18 kg. Fig 7 shows the temperature dependence of the mechanical characteristics of monocrystals of beryllium: σ_s - yield stress in compression, σ_b - UTS in compression; δ - total residual compression; δ_s - residual compression prior to the appearance of the first slip bands. Fig 8 shows the prismatic slip in monocrystals of beryllium: a - slip trace in a type-a face. Compression at 20°C by

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Study of the Plastic Properties of Monocrystals of Beryllium. II.

1.2%; X 10 000; b - trapeze-like slip trace in a type-a face. Compression at 400°C by 1.5%, X 432. Fig 9 shows photomicrographs of cross-sectional microcracks formed as a result of non-uniformity of shift in the slip along the slip bands. Fig 10 shows slip traces of a polygonized monocrystal of beryllium. The slip planes are wavy: polygonization blocks can be seen. The treatment consisted in compression by 0.6% at 20°C, annealing at 800°C for 3 hours, followed by repeated compression by 0.8% at 20°C, X 8000 The table on p 137 shows the crystallographic elements of slip, twinning and fracture and the temperature region in which they occur. Fig 11 is a standard stereographic projection of the basal plane (0001) of a monocrystal of beryllium. The orientation of monocrystals of beryllium is shown in Fig 12. The authors arrived at the following conclusions:

1. The essential aspect of plastic deformation of beryllium in a wide temperature range (-196° to +800°C) is slip along the base (0001) in the direction [1120]. The slip in beryllium differs fundamentally from that in

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Study of the Plastic Properties of Monocrystals of Beryllium, II.

other hexagonal crystals. Beryllium has a large number of different crystallographic twinning systems. Mechanical twinning is not responsible for the great brittleness of beryllium. Re-forming of twins within an entire crystal leads to an increased plasticity and strength of the crystal in subsequent slip. An unevenness in movement along basal slip planes has been observed. This causes the formation of microcracks along prism and secondary pyramidal planes. Thus the brittleness of beryllium is associated with a large number of cleavage planes which are exposed particularly strongly because of the non-uniformity of slip at low temperatures.

There are 12 figures, 1 table and 13 references, 8 of which are Soviet and 5 English.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR (Physico-technical Institute, Ac.Sc., UkrSSR)

SUBMITTED: December 24, 1957

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24(2)

AUTHORS: Garber, R. I., Gindin, I. A., Shubin, Yu. V. SOV/56-36-2-5/63

TITLE: The Slipping of Beryllium Single Crystals at Low Temperatures III (Skol'zheniye monokristallov berilliya pri nizkikh temperaturakh III)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 2, pp 376-384 (USSR)

ABSTRACT: This paper is a continuation of parts I and II (Refs 1, 2), in which the authors had investigated slipping along the basis plane (0001) of technically pure beryllium single crystals (99.7%) at various temperatures. The investigations described here were carried out with purer Be single crystals (99.98%) at 77 and 20°K. Further, slipping on (0001) under the influence of a deforming force forming an angle of 45° with the plane (0001) was investigated. The direction of displacement in the case of basic slipping was parallel to the lateral face of the investigated crystal - the diagonal of first order [1120] . Deformation was brought about by means of a machine which was especially constructed for operation at low temperatures (Refs 3, 4); the rate of deformation was 0.03 mm/sec. The character of slipping was found to be highly dependent on

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the stage of deformation. In the case of weak deformations, there is no immediate slipping along the strips, and displacement occurs in a thin layer resting against the strips. Thus, the part of the crystal between two strips is displaced as a whole. Residual stress causes elastic displacement of the opposite sign in the crystal layers resting against the strips. In the case of strong pressure slipping takes place along the strip, and strong relative displacement occurs. The formation of a saw-shaped profile of the crystal face is characteristic of this stage; this may, according to reference 8, be looked upon as a result of twinning on planes with large indices in the case of basic slipping. The discontinuity of displacement is explained as being due to the existence of impurities. Purification of the beryllium contributed towards rendering the course of displacement along each strip more continuous, which leads to a higher degree of plasticity. At 77°K the formation of whole packets of strips can be observed, which is very clearly shown by figure 7. The method of building up the face profile of deformed crystals makes it possible to determine the basic dimensions of the fine structure of the elementary slipping strips and of the packets. The twist noticeable between the

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strips can, in the first stage, be considered to be due to residual stress; this twist, which increases with deformation, must necessarily be explained in the advanced stage, when it attains 3°, as a result of twinning. In conclusion, the authors thank I. M. Fishman for constructing and producing the replicas and for making electron-microscopical recordings. There are 9 figures, 1 table, and 13 references, 10 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

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21(0) SOV/53-67-4-7/7

AUTHOR: Chentsov, N.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1957, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 500 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields.

V. Various Questions.

One of the most interesting lectures delivered at this Conference was that by I. A. Gindin, B. G. Lazarev, Ya. D. Starodubov and V. I. Khotkevich (KhPTI) on the polymorphism of metals at low temperatures; P. L. Kapitsa commented on this topic during the discussion. E. F. Tulitova, V. S. Kogan and B. G. Lazarev (KhPTI) investigated the system hydrogen-deuterium by the methods of low-temperature-radiography, thermal analysis, and the visual observation of crystallization. M. I. Amirkhanov, Sh. Ch. Amirkhanova and N. I. Bashirov investigated the thermomagnetic properties of compounds of the type

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$A^{III}B^{V}$ and $A^{II}B^{VI}$, and dealt with the phenomenon of the "photon wind" predicted by Gurevich; the investigation was carried out at the Dagestanskiy filial AN SSSR (Dagestan Branch, AS USSR). E. M. Reynov and A. P. Sotnov (LPTI - Leningrad Physico-technical Institute) gave a report on the measurement of the electricity limit of tin- and indium polycrystals at very low temperatures (1°K), and V. M. Reynov and N. I. Krivko (LPTI) spoke about attempts made to find the expected diamagnetic resonance on polarons in cuprous oxide. G. R. Khutsishvili (TGU i Institut fiziki AN Gruzinskoy SSR - Tbilisi State University and Institute of Physics AS Gruzinskaya SSR) carried out a theoretical investigation of the Overhauser effect in non-metals. Lomkadze investigated the electron- and nuclear (proton) resonance in diphenylpicryl hydracyl at helium temperature. B. N. Samoylov spoke about experiments carried out concerning the orientation of Co^{60}- and Au^{198}-nuclei (in iron) at extremely low temperatures. B. P. Zakharchenya and Ye. F. Gross (LPTI) investigated the absorption spectrum of a cuprous oxide crystal in the magnetic field at helium temperature and observed the effect of magneto-optical oscillations. V. P. Peshkov and K. P. Malkov gave information concerning scientific work of Soviet scientists in foreign countries (zagranichnaya nauchnaya komandirovka), and E. V. Shpol'skiy spoke about the abstracting journal "Fizika".

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The head of the department for problems of the physics of low temperatures, Academician P. L. Kapitsa and the President of the Academy of Sciences Gruzinskaya SSR, Academician N. I. Muskhelishvili closed the Conference. The 6. All-Union Conference on the Physics of Low Temperatures will be held in June and July 1959 in the city of Sverdlovsk.

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B122/B063

18 7510

AUTHORS: Gindin, I. A., Starodubov, Ya. D.

TITLE: Slippage Along the Boundaries of Twins During Direct and Reciprocal Twinning of Iron

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1070 - 1081

TEXT: The present paper describes some peculiarities of deformation occurring in direct and reciprocal twinning of iron on the boundaries of these twins. It was the aim of the authors to find the cause of the different behavior of the interfaces under static load. Preceding papers (Refs. 1 and 2) have shown that the twin layer became thicker, and that one interface of the twin layer remained immobile, while the other was shifted. For their study , the authors used iron (degree of purity: 99.99%, grain diameter: 2 - 2.5 mm) which was annealed for five hours at 800° after polishing the boundary faces. A multistage deformation at the temperatures of liquid nitrogen was carried out on the samples with room-temperature heating in between. It was thus possilbe to observe the appearance and disappearance of the twin

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Slippage Along the Boundaries of Twins During Direct and Reciprocal Twinning of Iron

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double layer, as well as its boundary shift with increasing load. The deformation to be reached per deformation step was chosen from 0.1-0.5%. Changes were observed by the microinterferometric method with a microscope of the type МИИ-4 (MII-4) and by variations arising in the etched lines. Experiments established that the lines suffer a break on compression and are displaced on a boundary plane. This displacement was likewise observed on the break of the interference stripes on one boundary. The displacement, however, did not increase with further increasing load. If the displacement was missing in the initial deformation stage (it could not be observed on all identical boundary layers of a twin system), it did no more arise on any further intensification of the deformation. It is concluded therefore that the slippage along the plane (112) must take place before the twin formation, i. e. while the lattice changes over to the twin formation. An "accomodation region" often forms besides the displacement on the slip plane. Still, one phenomenon does not necessarily entail the other. Slippage occurs in the direction [111], which coincides with the direction of displacement in the twin formation. The twin layers again disappear with load having an inverse sign (so-called mutual twin formation). The critical stress for the reciprocal twin formation is somewhat higher than that of

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Slippage Along the Boundaries of Twins During Direct and Reciprocal Twinning of Iron

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the direct twin formation. A table offers data on the twin formation for direct and reciprocal twins. Various explanations for the formation and removal of twins are discussed. The authors finally thank R. I. Garber and B. G. Lazarev for their discussions. There are 9 figures, 1 table, and 7 references: 5 Soviet, 1 German, 1 British

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Physicotechnical Institute of the AS UkrSSR, Khar'kov)

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81620
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B122/B063

18.8200

AUTHORS: Garber, R. I., Gindin, I. A., Polyakov, L. M.

TITLE: Dispersion and Re-establishment of Contacts Between Microblocks During Plastic Deformation

PERIODICAL Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1089 - 1095

TEXT: The low strength of solid bodies after deformation is ascribed to dislocations, fractures, and microcracks and the resulting concentration of strains which attain the value of theoretical strength in microregions. Furthermore, the formation, splitting, and disorientation of microblocks are observable. The concentration of strains may be regarded as an increase in latent energy which is due to the extension of the inner surface brought about by disorientation. The surface energy of the liberated parts of the block surfaces would pass over into latent energy. The block dimensions themselves have a specific value for every material. According to B. M. Rovinskiy and L. M. Rybakova (Ref. 7), this value constitutes a mean value of split and restored blocks. In this connection, the saturation of the latent deformation energy corresponds to the stabilization of the mean block

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Dispersion and Re-establishment of Contacts Between Microblocks During Plastic Deformation

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dimensions. The surface energy is determined by formula: $\gamma = \frac{\alpha}{\beta} \frac{l\rho Q}{\sigma}$ (1), where $\alpha = v/l^3$, v denotes the volume of the block, l its length, $\beta = S/l^2$, S is the surface, ρ is the material density, Q is the latent energy of plastic deformation on saturation referred to the sample mass, and σ is the mean surface tension. As an example, γ has the value 0.5 for copper, i.e., on plastic deformation of copper a considerable part of the block surfaces is without contact with the neighboring blocks. It is then considered that a part of the latent deformation energies must be also ascribed to other causes, such as lattice defects, dislocations, and residual stresses. The latter are determined in metals roentgenographically, and do not amount to more than 2 % of Q. Atomic dispersion and imperfections, determined from the change of resistivity as a result of plastic deformation, correspond to only 5 % of the latent energy Q. Thus, almost the entire latent energy of the plastic deformation was found to be present as the energy of the free block surfaces. The process of contact re-establishment was studied on pressed and high-vacuum heated copper disks, on the change of the flow velocity of hydrogen through iron tubes, which were deformed at the temperatures of liquid nitrogen, and finally, on the change, caused by annealing,

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Dispersion and Re-establishment of Contacts Between Microblocks During Plastic Deformation

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in light dispersion intensity of deformed rock salt samples. The setups used for the investigation are shown in Figs. 1 - 5, and respective results in Figs. 6 - 9. The studies revealed that the activation energy of contact formation in copper decreases with rising pressure, i.e. the said formation proceeds very quickly at a certain pressure and also at low temperatures. In the case of iron, a recrystallization occurs under the given conditions, which, however, does not necessarily give rise to contacts. It is concluded therefrom that at a certain deformation stage there is a firm interlinkage between the various contact faces of the blocks besides dispersion and disorientation. There are 9 figures and 15 references: 10 Soviet, 3 English, 1 Japanese, 1 American.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR, Khar'kov (Physico-technical Institute of the AS UkrSSR, Khar'kov)

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81621
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B122/B063

18.8200

AUTHORS: Garber, R. I., Gindin, I. A., Lazarev, B. G., Starodubov, Ya.D.

TITLE: Low-temperature Recrystallization of Copper

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1096 - 1098

TEXT: The authors of the present article studied the recrystallization of copper which was first deformed at the temperatures of liquid hydrogen and nitrogen, and was then subjected to recrystallization at room temperature. Tubular copper samples (diameter: 1.5 mm; wall thickness: 0.45 mm) were used. The samples were first annealed at 800°C for 8 hours (at 10^{-6} torr). Special care was devoted to the perfect cleanliness of the inner wall of the tube. The sample was deformed in vacuo at 20 and 4.2°K perpendicular to the tube axis until the inner walls touched, and further until the plastic deformation $\delta = 23$ %. The sample was then heated at low pressure, and kept at room temperature for 10 - 15 hours. Recrystallization was observed on a cut of the cross section of the tubes after deep etching, by using a metallographical microscope of the type МИМ-6 (MIM-6) (Figs. 1 and 2). Small

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bridges of recrystallization grains were observed along the contact planes. With dropping deformation temperature the number of outgrowing grains increased. The experiments showed that copper deformed at low temperatures is well recrystallizable already at room temperature, and that the idea of temperature threshold of recrystallization is a preliminary one, i.e., when constructing the recrystallization diagram it is necessary to consider the temperature at which the plastic deformation is activated. There are 2 figures and 6 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR, Khar'kov (Physico-technical Institute of the AS UkrSSR, Khar'kov)

SUBMITTED: August 11, 1959

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69698
S/126/60/009/03/021/033
E193/E483

18.8200

AUTHOR: Gindin, I.A.

TITLE: On the Effect of Preliminary Straining at 300°K on the Mechanical Properties of Technical Iron at 77°K

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 3, pp 447-455 (USSR)

ABSTRACT: According to the theory of dislocations, brittleness of the body-centred cubic metals is due to blocking of dislocations on dissolved impurities (Cottrell' atmosphere) or other obstructions. If this is true, it should be possible to lower the critical temperature of low-temperature brittleness by preliminary deformation in the temperature range in which the metal is ductile, followed by cooling through the temperature range within which blocking of dislocations takes place. The object of the investigation described in the present paper was to check this hypothesis by studying the low-temperature mechanical properties of technical iron, containing 0.03% C, pre-strained at room temperature. The experimental tensile test pieces (1.5 x 3.0 mm cross-section, 10 mm gauge) were prepared from a central portion of a

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On the Effect of Preliminary Straining at 300°K on the Mechanical Properties of Technical Iron at 77°K

forging. In order to completely remove the cold-worked surface layer, the test pieces were etched and electrolytically polished, after which they were vacuum annealed at 300°C for 4 h. In the course of the investigation the microstructure, grain size, character of deformation and distribution of the slip bands near the fracture of the test piece were studied. The treatment, illustrated in Fig 1, to which the test pieces were subjected comprised three stages: (a) preliminary straining within the elastic range (up to a stress σ_0) or preliminary plastic deformation (up to elongation δ_0) at room temperature (300°K), at a low (v_1 = 0.4 micron/sec) strain rate; (b) slow cooling (approximately 5°/min) of the test pieces under the load applied originally (ie with σ_0 or δ_0 maintained constant) to the liquid nitrogen temperature (77°K); straining the test piece to fracture at 77°K, at the normal strain rate of V_2 = 30 micron/sec. In all 12 specimens were investigated; the degree of preliminary elastic or plastic straining to which each specimen had

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been subjected is shown on a strain/stress diagram reproduced in Fig 2; numbers given by the points on this diagram denote the number of a given test piece, while the position of each point shows the magnitude of stress σ_0 and elongation δ_0 attained in preliminary straining. The numerical values are tabulated on p 449 under the following headings: number of the test piece; stress applied in the elastic range (σ_0, kg/mm^2); degree of plastic deformation (δ_0, %). The results of the tensile tests at 77°K are reproduced in Fig 3, showing the automatically recorded strain/stress diagrams, curves a to z relating to specimens, subjected to preliminary straining, given by the following data:
a - not subjected to preliminary straining;
b - σ_0 = 7.1 kg/mm^2; v - σ_0 = 8.7 kg/mm^2;
g - σ_0 = 15.8 kg/mm^2; d - σ_0 = 19.5 kg/mm^2;
e - σ_0 = 19.9 kg/mm^2; zh - σ_0 = 21 kg/mm^2; z - δ_0 = 1%;
(the load and strain are represented in these diagrams in the scale 1 mm = 18 kg and 1 mm = 45 microns respectively).

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On the Effect of Preliminary Straining at 300°K on the Mechanical Properties of Technical Iron at 77°K

The relationship between the ductility of the test pieces at 77°K and the degree of pre-straining at 300°K is illustrated in Fig 4, where elongation (δ, %) and reduction of area (ψ, %) are plotted against σ_0 (kg/mm^2) on the left-hand side diagram and against δ_0 (%) on the right-hand side diagram; the experimental points denoted by open circles relate to δ, crosses relate to ψ, and the triangle indicates δ of test piece Nr 1, which had not been subjected to preliminary straining; numbers ascribed to each point denote the number of the test piece. Fig 5 shows how the yield point σ_s, kg/mm^2, (open circles) and the true tensile strength σ_b, kg/mm^2 (full circles) at 77°K varied with the degree of pre-straining at 300°K, given in terms of σ_0 (left-hand graph) or δ_0 (right-hand graph), the triangle indicating the true tensile strength of test piece Nr 1. A characteristic feature of test pieces which, at 77°K, failed in a ductile manner (test pieces Nr 2 to 6) was twin formation and the appearance of slip bands. It was revealed by

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On the Effect of Preliminary Straining at 300°K on the Mechanical Properties of Technical Iron at 77°K

metallographic examination of test pieces tested at 77°K that the slip bands were formed already in the elastic range long before the yield point was reached. The microstructure of a test piece, pre-strained at 300°K under $\sigma_o = 8.9$ kg/mm^2 and tested to fracture at 77°K, is illustrated in Fig 6 (x 100) showing (a) twins and slip bands at the point of fracture and (b) density of twins at a distance of 1.5 mm from the point of fracture. The variation of density of twins across the length of the test piece is illustrated in Fig 7, where N_g/N (%) is plotted against the distance (mm) from the point of fracture, curves 1 and 2 relating to specimens which have failed in the brittle and ductile manner respectively; N_g is the total number of grains in the portion of the test piece $dx = 0.25$ mm long and 3 mm wide and N is the number of grains with twins in that portion. The relationship between the intensity of twin formation I, % (calculated from the formula given at the bottom of p 448 as Eq (2)) and the magnitude of stress σ_o applied

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during preliminary straining, is illustrated by the graphs reproduced in Fig 8 where the number ascribed to each point denotes the number of the test piece. Regarding the slip bands, they are straight when formed in the initia. stages of the formation and curved in the heavily deformed material. Fig 9 (x 166) shows the straight and curved slip bands in specimen Nr 3, deformed at 77°K to δ = 4%. Curved slip bands in the region of local deformation in specimen Nr 3, deformed at 77°K to δ = 8% are shown in Fig 10 (x 360). Finally, Fig 11 shows the local deformation near the grain boundaries and broadening of the grain boundaries, revealed by micro-interference meter in test piece Nr 7, pre-strained at 300°K under a stress equal to the yield point. Several conclusions were reached. (1) Technical iron subjected to preliminary straining in the elastic range at 300°K and then cooled under load to 77°K, undergoes a transition from brittle to ductile condition; this transition is accompanied by an increase in the true

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tensile strength, as compared with the brittle strength of technical iron. (2) Technical iron, pre-strained under optimum conditions (σ_0 = 9 kg/mm^2) is characterized by elongation = 10.5%, reduction of area = 23% and tensile strength 20% higher than that of untreated material. (3) The transition of technical iron from brittle to ductile condition is due to special conditions of generation of elementary displacements brought about by high temperature straining at low rates of strain and cooling under load; these conditions are favourable for the formation of arrays of dislocations on various defects and for breaking these arrays without destroying the continuity of the metal. (4) Technical iron, pre-strained at 300°K, begins to deform plastically at 77°K under a stress lower than the yield point. (5) Brittle fracture of technical iron is not caused by twinning, since it has been found that maximum ductility corresponded to maximum intensity of the twin formation. (6) The critical temperature of cold brittleness of

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On the Effect of Preliminary Straining at 300°K on the Mechanical Properties of Technical Iron at 77°K

technical iron is not lowered by pre-straining at 300°K. There are 11 figures, 1 table and 12 references, 8 of which are Soviet and 4 English.

ASSOCIATION: Khar'kovskiy fiziko-tekhnicheskiy institut AN USSR (Kharkov Institute of Physics and Technology AS UkrSSR)

SUBMITTED: July 15, 1959

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GINDIN, I.A.; LAZAREV, B.G.; STARODUBOV, Ya.D.

Characteristics of the mechanical properties of lithium connected with low-temperature polymorphic transitions. Fiz. met. i metalloved. 10 no.3:472-480 S '60. (MIRA 13:10)

1. Fiziko-tekhnicheskiy institut AN USSR.
(Lithium--Testing) (Metals at low temperatures)

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B006/B017

24(2), 18(0)

AUTHORS: Garber, R. I., Gindin, I. A.

TITLE: The Physics of the Strength of Crystal Bodies

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 1, pp 57-110 (USSR)

ABSTRACT: Although modern engineering makes ever increasing demands on the strength of materials there exists no modern physical theory of strength. The present paper gives a survey on the up-to-date physical concepts on the strength of crystalline bodies, the reasons for the low strength of the real materials, and the most important possibilites of raising them. Part 1 deals with the microscopic theory of strength, especially with the theory by Ya. I. Frenkel'; Frenkel' proved that the critical shear stress in the case of which the lattice becomes unstable is equal to $G/2\pi$ where G denotes the modulus of rigidity; this value is much higher than that for plastic crystals ($10^{-5}G$). By more accurate investigations other authors obtained a still theoretical value of G/30 which is much higher than that measured in single metal crystals. The reasons for this discrepancy are briefly discussed. Part 2 deals with the structural defects of a real crystal and gives a short survey. Part 3 deals somewhat more in detail with the influences of the microcracks

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The Physics of the Strength of Crystal Bodies

S/053/60/070/01/002/007
B006/B017

(P. A. Rebinder, Ya. I. Frenkel', B. Ya. Pines, A. F. Ioffe, S. N. Zhurkov, A. V. Stepanov; experiments and their results are mentioned). Part 4 reports on the scale effect and the strength of the thread-like crystals (A. P. Aleksandrov, S. N. Zhurkov - statistical theory, R. I. Garber - experiments with calcite crystals; figures 3-9 show different characteristics of strength, also Bartenov and Chepkov are mentioned). Part 5 gives a short survey on the statistical theory by N. N. Davidenkov, Ya. I. Frenkel' and T. A. Kontorova, and part 6 deals with the origin of cracks in the crystal nucleus (theory by A. V. Stepanov and its verification by N. N. Davidenkov, Ye. M. Shevandin, and M. V. Klassen-Neklyudova; experiments and their results obtained by S. O. Tsobkallo, Stepanov, S. N. Zhurkov, T. P. Sanfirova et al). Part 7 presents the theoretical and experimental investigation results of dislocations and micro-cracks (Ye. D. Shchukin and V. I. Likhtman). Part 8 investigates the influence of the surrounding medium on the mechanical strength of solids (solution of the body and extension of surface defects and adsorption; A. F. Ioffe, P. A. Rebinder, D. I. Shil'krug). Part 9 deals with the dependence of strength,

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on temperature and time (I.V. Obreimov, S. N. Zhurkov, B. Ya. Pines, I. Ya. Dekhtyar, T. P. Sanfirova, and K. A. Osipov). Part 10: destruction on creeping, part 11: cold brittleness (theory by Ioffe for rock salt; experiments by N. N. Davidenkov and T. N. Chuchman; microstructure photographs by Garber, Gindin, Konstantinovskiy, Starodubov). Part 12: discussion of the structure of high-strength alloys (G. V. Kurdyumov, B. M. Rovinskiy, L. M. Bybakova, B. M. Rovinskiy, Perkas, and Khondras, V. A. Il'ina, V. K. Kritskaya, Grusin, Tyutyunik, Entin, V. I. Startsev, P. N. Aronova). Part 13 and 14 are devoted to fatigue and hardening; the two types of hardening are briefly discussed according to R. I. Garber. In conclusion it is then pointed out that the strong difference between theoretical and experimental strength is due to structural defects and that strength could be increased by a regular stress distribution in thermal and mechanical processing. There are 38 figures and 223 references, 108 of which are Soviet.

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S/181/61/003/001/021/042
B006/B056

AUTHORS: Garber, R. I. and Gindin, I. A.

TITLE: Elastic deformation and thermal expansion

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 176-177

TEXT: When investigating deformations with temperature changes, thermal expansion is usually considered to be independent of deformation; the explanation of certain effects occurring in the temperature change of elastically deformed specimens, however, requires consideration of the stress dependence on the coefficient of thermal expansion. This may be done by taking third-order terms into account in the series expansion of the energy of elasticity. Whereas this is not possible in general, not only the required stress dependence of the expansion coefficient may be determined, but also the coefficients entering into the latter may be estimated for the special case of uniaxial deformation or uniform expansion in all directions. This is done in the present work. For a diatomic solid, the stress $\sigma = -f\varepsilon + g\varepsilon^2$ (1), where ε is the relative deformation, and f and g are constants. If ε is considered the sum of shifts due to applied

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forces (ε_1) and to thermal vibrations (ε_2), then $\sigma = \sigma_1 + (2g\varepsilon_1 - f)\varepsilon_2 + g\varepsilon_2^2$. Averaging over time gives $\overline{\sigma} = \sigma_1$ and $\varepsilon_2 = g\overline{\varepsilon_2^2}/(f - 2g\varepsilon_1)$. $\overline{\varepsilon_2^2}$ may be determined from the mean density of the energy of elasticity of thermal vibrations: $\overline{W} \simeq \int_0^T \frac{C_V}{V}\, dT$, and $\overline{W} = -f\overline{\varepsilon_2^2}/2 + g\overline{\varepsilon_2^3}/3$. By taking into account that ε_2^3 small quantity changing its sign, one may assume that $\int_0^T \frac{C_V}{V}\, dT \simeq -f\overline{\varepsilon_2^2}/2$. If $\overline{\varepsilon_2} = \int_0^T \alpha\, dT$, where α is the coefficient of thermal expansion, one obtains $\alpha = 2gC_V/Vf(2g\varepsilon_1 - f)$. With $\sigma_1 = 0$, $\varepsilon_1 = 0$, $\alpha = \alpha_0 = -2gC_V/Vf^2$, one obtains $\alpha = \alpha_0(1 + \beta\varepsilon_1)$. On the other hand, it follows from the Grüneisen relation that $\alpha_0 = KC_V\gamma/3V$, where K denotes compressibility, γ the Grüneisen coefficient, V the atomic volume. Thus, one obtains $\beta = -Kf\gamma/3$. From (1)

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Elastic deformation and thermal expansion

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B006/B056

it follows that $f \simeq -E$, where E is the modulus of linear elasticity. The value of β was calculated for several metals:

Metal	β
Pd	1.3
Ag	1.65
Pt	1.65
Cu	1.7
α-Fe	1.9
Ni	2.1
W	2.1
Co	2.3

Small deformations naturally lead to comparatively low changes in the coefficient of thermal expansion; in the case of high stress gradients, the change may become considerable and cause noticeable effects. There are 1 table and 1 Soviet-bloc reference.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Institute of Physics and Technology AS UkrSSR, Khar'kov)

SUBMITTED: June 6, 1960

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20798

24.7500 1143,1160,2807,1418

S/181/61/003/003/024/030
B102/B205

AUTHORS: Garber, R. I., Gindin, I. A., and Shubin, Yu. V.

TITLE: High strength of single crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 918-919

TEXT: Numerous experimental studies of crystals of rock salt and other substances, performed by A. F. Ioffe and A. V. Stepanov, seem to indicate that the continuity of the crystals is disturbed in plastic deformation. By retarding or accelerating the plastic deformation of rock crystal, Stepanov was able to change their strength by a factor of 30. The highest strength is displayed by filament crystals if the entire process of deformation up to destruction is plastic. Iron filaments elastically deformed by 4.8%, for example, reach a strength of 1340 kg/mm^2. When the first indications of sliding are noticeable, the resistance of filament crystals to resistance decreases rapidly. If the orientation of a macroscopic crystal toward the external force is such that plastic deformation (chiefly sliding and twinning) is excluded, increased strength can be expected. Hexagonal crystals which have a limited number of slip and twinning planes at low temperatures, are partic-

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ularly suitable for such experiments. Plastic deformation of these crystals is effected chiefly by sliding in the basal plane (0001), on the faces of prisms of first order $\{10\bar{1}0\}$, and by twinning in the planes $\{10\bar{1}2\}$. This was studied with the help of prismatic Be single crystals (1.6 × 1.5 × 3 mm) of 99.9% purity. The crystals were compressed at 77°K by a force perpendicularly acting on the basal plane (deformation rate: 0.013%/sec). There were no indications of plastic deformation up to destruction. Sliding and twinning were impossible since no components of this force were acting in the respective directions. Under these conditions, the Be single crystals actually showed a very high strength: destruction occurred only under a pressure of 410 kg/mm^2; the crystal suddenly decomposed into very fine powder. With other positions of the basal plane, destruction occurred already at 34 kg/mm^2. At room temperature, the maximum stress is only 210 kg/mm^2 (perpendicular to the basal plane). Similar experiments were carried out with calcite single crystals (6 × 4 × 10 mm) at 300°K, which are deformed only by twinning. The orientation of the single crystals was such that the twinning plane (110) formed an angle of 45° with the axis of the specimen and the direction of displacement [001], opposite to the direction in which the tangential stresses acted, which deformed the specimen at a

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20798

S/181/61/003/003/024/030
B102/B206

High strength ...

rate of 0.004%/sec. A strength of 23 kg/mm^2 was attained in this case. The lower bound is 40 g/mm^2. There are 7 references: 4 Soviet-bloc and 3 non Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Institute of Physics and Technology, AS UkrSSR, Khar'kov)

SUBMITTED: August 10, 1960

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20799

24.7500 1143, 1160, 2807, 1418

S/181/61/003/003/025/030
B102/B205

AUTHORS: Gindin, I. A., Lazarev, B. G., and Starodubov, Ya. D.

TITLE: Discontinuous character of plastic deformation at low temperatures

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 920-925

TEXT: The discontinuous character of plastic deformation of crystalline bodies has been known long (A. F. Ioffe, Ehrenfest, M. V. Klassen-Neklyudova), and the various effects of discontinuous deformation have been investigated many times. In the authors' view, however, this problem has not yet been studied in detail, which is the purpose of the present work. Elongation and compression diagrams of the following metals were recorded by a machine equipped with a sensitive, rigid dynamometer between 1.4 and 77°K and at a deformation rate of 30 μ/sec: aluminum, beryllium, bismuth, tungsten, iron, cadmium, potassium, lithium, magnesium, molybdenum, copper, sodium, nickel, tin, lead, antimony, silver, mercury, tantalum, titanium, chromium, cesium, zinc, zirconium, and uranium. In this connection, it was necessary to classify the deformation jumps and to make a detailed study of

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a new kind of faults which are important at 4.2°K and below this temperature. The principal results of these investigations are published here. The discontinuity of the low-temperature deformation is essentially caused by: 1) mechanical twinning, 2) polymorphous transitions, 3) peculiarities of the plastic deformation of high-purity metals (mechanical recrystallization, sliding along the grain faces, twinning), 4) relaxation processes with a regular increase of jumps. These four cases were investigated individually. Figs. 1, 2, and 3 show the diagrams of deformations on mechanical twinning (1), polymorphous transition (2), and of relaxative jumps (3). These diagrams were recorded by the computer machine. Ad 1: The authors studied the extension elongation of coarse-grained iron of 99.99% purity at 77°K. The jumps are only caused by twinning processes. The kind of the effect depends largely on the grain size. Fine-grained material showed no twinning jumps. Jumps of this kind can thus be prevented by an adequate thermomechanical treatment of the material. Ad 2: Jumps due to polymorphous transitions occur in the compression of Li or Na. Fig. 2 shows diagrams obtained for Li (purity of 99.93%) at 20 (1), 4.2 (2), and 1.4°K (3). The transition into the stable low-temperature modification takes place after a certain degree of deformation has been

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reached, and is accompanied by the occurrence of considerable faults. These jumps occur only if the deformation takes place below the temperature of the polymorphous transition. Ad 3: High-purity metals, such as Al (99.994%) and Fe (99.99%) show mechanical recrystallization within the range of helium temperatures, i.e., grains are formed, which are larger than the initial ones. The process is somehow similar to mechanical twinning. Ad 4: Whereas the effects described above occur only under certain conditions, all the metals investigated show deformation jumps at sufficiently low temperatures and a corresponding stress strain, which are due to relaxation processes. These are characterized by a certain rule (Fig. 3 shows it for Fe (99.99% pure) at 4.2°K). They are due to the fact that elastic energy accumulates and is released at a certain value. For some of the metals examined here, a table contains the temperature and the degree of deformation at which the elongation process takes place discontinuously and regularly. In some metals, an increased elevated strain stress corresponds to an elevated temperature (e.g., in the case of Na), but there is still a temperature threshold above which no such jumps will appear any longer, not even at maximum stress; (for Na, e.g., above 20°K). The rules governing the jumps are observable both during compression and elongation. There are 7 figures,

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Discontinuous character ...

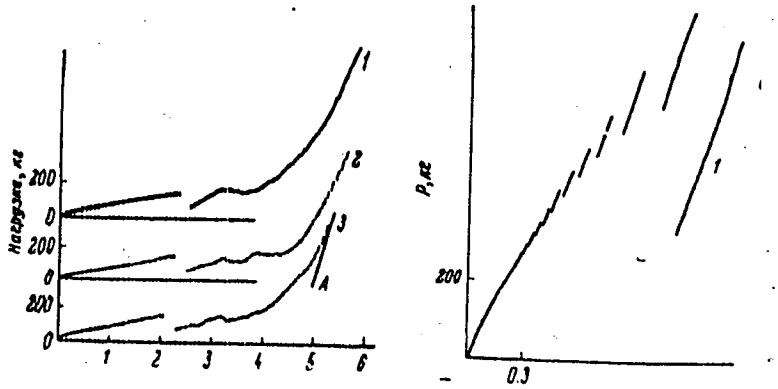
S/181/61/003/003/025/030
B102/B205

1 table, and 18 references: 16 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION:- Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Institute of Physics and Technology, AS UkrSSR, Khar'kov)

SUBMITTED: August 10, 1960

Figs. 2 and 3



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22051

24.7500 1160, 1136, 1143

S/181/61/003/004/017/030
B102/B214

AUTHORS: Garber, R. I., Gindin, I. A., and Shubin, Yu. V.

TITLE: Orientation dependence of the slipping and rupture of single crystals of beryllium on stretching

PERIODICAL: Fizika tverdogo tela, v. 3, no. 4, 1961, 1144-1151

TEXT: The present paper, which is in continuation of earlier investigations, makes a contribution to the clarification of the structural rules of beryllium which is highly anisotropic with respect to its mechanical properties. The single crystals studied were bred from a 99.98% pure starting material, using the method of slow cooling of the melt (crystallization rate: 5 mm/hr). Single crystals of 80 mm length and 60 mm diameter were obtained. The orientation was determined by X-rays. The crystals were cut in different forms by a special electro-spark device, after which they were etched, ground, and polished, first chemically and then mechanically. The tensile tests were made at the following angles to the basal plane: α = 0, 5, 10, 15, 20, 26, 45, 70, and 90° (see Fig. 2). The shearing direction [11$\bar{2}$0] coincided with one of the lateral faces.

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The stretching was done at a constant rate of 0.005%/sec at room temperature. The crystallographic elements of plasticity and rupture were studied by crystallographic and microinterference methods. The results of the investigations are illustrated in Figs. 3 and 4. The curve P_{β} (Fig. 3) shows the α-dependence of the ultimate strength. The strongly non-monotonic behavior of this curve contradicts the law of constancy of normal stress on brittle rupture. The curve $P_{2\beta}$ is drawn according to this law and does not represent the experimental facts in any way. The experimental curve $P_{\beta}(\alpha)$ can be described well by the equation $P_{1\beta} = K(\sin^3\alpha\cos\alpha)^{-1/2}$ in the angular range $\alpha = 20\text{-}70^{\circ}$, where $K = 3$ kg/mm^2. This equation corresponds to the law $(\tau\sigma)_{destr} = K^2$. However, the experimental results do not correspond to this law between 0 and 15°. At $\alpha > 20^{\circ}$ slipping and rupture occur in the same system of planes, namely, (0001). At $\alpha < 20^{\circ}$, the crystallographic elements of plasticity and rupture alter and do not coincide (slipping: $\{10\bar{1}0\}$; rupture: $\{11\bar{2}0\}$). Further, investigations of the structure were made before and after the

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rupture. The following conclusions are drawn from the results obtained: Highly pure Be single crystals and commercially pure crystals show marked anisotropy in their mechanical properties as well as in the elements of plasticity and rupture on stretching. There is an orientation limit which is characterized by the plasticity at room temperature. The peculiarity of rupture at this orientation is the absence of ideal cleavability and a complicated character of the fracture. Improved plastic properties of polycrystalline Be are obtained by preparing a definite fine-grained texture for which, in the process of deformation, the cleavage in the principal planes of rupture is strongly localized. There are 7 figures and 14 references: 4 Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov (Institute of Physics and Technology, AS UkrSSR, Khar'kov)

SUBMITTED: August 1, 1960

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S/126/61/011/001/005/019
E111/E452

AUTHORS: Gindin, I.A., Lazarev, B.G. and Starodubov, Ya.D.

TITLE: Low-Temperature Metallography of Lithium

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.1, pp.46-51

TEXT: The authors point out that no information is yet available on microstructural changes during martensitic transformation of alkali metals, in cooling to low-temperatures and heating or after "deformational" polymorphic transformation; or on the mutual effect of transformations on microstructure. In their present investigation, which is a continuation of their work in this field, the authors have studied by low-temperature metallography the microstructure of lithium and its changes in the polymorphic-transformation temperature region. Polished sections were prepared as previously described (Ref.1). For preliminary low temperature investigations, previously prepared lithium specimens (Ref.1) were used; these had been stored in liquid nitrogen and photomicrographs corresponding to this temperature could then be obtained directly. For other temperatures, a special cryostatic apparatus was constructed in which the required specimen temperature

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E111/E452

Low-Temperature Metallography of Lithium

was obtained by suitable selection of thermal resistance between it and a massive copper heat conductor whose other end was immersed in cooling liquid. The temperature of the 7 x 7 x 2 mm specimen, which could be microscopically observed, was measured with a copper-constantan thermocouple or, for below 20°K, with an indium resistance thermometer. The whole was inside a vacuum jacket connected to a separate pump and containing activated charcoal. The optical system was part of a type ПМТ-3 (PMT-3) apparatus with a photographic attachment. Microphotos show the original room temperature microstructure and also needles of the hexagonal modification and a chain of martensitic needles with a grain-boundary fracture. The extent of martensitic transformations does not exceed 25 to 30% and volume changes produce shear deformation. A further figure shows the changes from the original microstructure at a given point on the section during repeated cooling and warming. Preliminary plastic deformation at 78°K was found to impede formation of the hexagonal modification on subsequent cooling below the martensitic point: on the microstructure, wavy slip lines are visible which represent regions of localized face-centred cubic

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E111/E452

Low-Temperature Metallography of Lithium

structure. This effect is similar to that in body-centred cubic metals (Ref.11). The work provides some confirmation for the authors' previous conclusions (Ref.1) on the behaviour of lithium. The low-temperature improvement of the mechanical properties of this metal is attributable to the fine dispersion of the two-phase structure produced through "deformational" polymorphous change. There are 6 figures and 11 references: 8 Soviet and 3 non-Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR (Physicotechnical Institute AS UkrSSR)

SUBMITTED: June 28, 1960

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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22966

18.8200

S/126/61/011/005/014/025
E193/E183

AUTHORS: Gindin, I.A., Starodubov, Ya.D., and Vasyutinskiy, B.M.

TITLE: Plasticity and brittleness of cast molybdenum at temperatures between 4.2 and 700 °K. I.

PERIODICAL: Fizika metallov i metallovedeniye, Vol.11, No.5, 1961, pp. 794-800

TEXT: The object of the present investigation was to explore the possibilities of low-temperature application of refractory metals such as Mo, Cr, W, Nb, etc. To this end, the mechanical properties of Mo were determined by means of the standard tensile test at 4.2-700 °K, and the effect of preliminary heat- and mechanical treatment on the transition temperature from the ductile to brittle fracture was studied. Mo of 99.95% purity was used in the experiments, the main impurities consisting of (%): 0.005 Fe; 0.01 Ni; 0.017 Ca; 0.002 Al; 0.002 O; 0.0009 N; 0.0006 H. To ensure uniform grain size, the ingots cast in vacuum-arc furnace were hot-rolled at 1000 °C to 50% reduction in thickness, spark-machining having been used for the preparation of flat, tensile test pieces of 7 mm gauge length and 2 mm^2 cross-section.

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22966

S/126/61/011/005/014/015

Plasticity and brittleness of cast E193/E183

After machining the test pieces were vacuum-annealed at 1280 °C. This treatment reduced the gaseous impurity content and produced a coarsely-crystalline structure with the average grain size of 200-400 μ. The tensile tests were carried out at 4.2, 20, 77, 183, 200, 223, 243, 300, 435 and 700 °K; at two rates of strain, 0.4 and 30 μ/sec. Some of the results obtained at the rate of strain of 0.4 μ/sec are reproduced in Fig.3, where the yield point (σ_s), U.T.S. (σ_b) and the true tensile strength (σ_u) measured in kg/mm^2 are plotted against the test temperature (°K). It will be seen that all these properties increase with decreasing temperature. The point of intersection of the σ_s and σ_b curves determined the transition temperature from ductile to brittle fracture, which in this case was 183 °K. The unusual feature of curves shown in Fig.3 is that they all pass through a maximum at approximately 80 °K, since it is generally believed that the tensile strength in the brittle fractural region does not depend on temperature. With increasing rate of strain, both σ_s and σ_b increased, and the temperature of the transition from ductile to brittle fracture was shifted to 208 °K. The plastic properties of Mo have been found to decrease with decreasing temperature at a rate which increases with

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S/126/61/011/005/014/015

Plasticity and brittleness of cast E193/E183

increasing rate of strain. This is illustrated in Fig.5, where elongation (δ, %) and reduction of area (ψ, %) are plotted against the test temperature (°K) for specimens extended at 0.4 (open circles and squares) and 30 μ/sec (black circles and triangles). In the second stage of the present investigation, the tensile test pieces were subjected to the following treatment: (1) loading at room temperature and at a rate of strain of 0.4 μ/sec to attain a stress equal to 0.5 σ_s; (2) slow cooling under constant load to 77.2 °K and holding at that temperature for 1-1.5 hours. It was found that after this preliminary treatment, the test pieces tested at 183 °K (i.e. at the critical temperature) exhibited some degree of ductility (δ 5%). Fig.6 shows the actual load (kg) versus strain (μ) curves for Mo tested at 183 °K at a rate of strain of 0.4 μ/sec for untreated (curve 1) and treated (curve 2) specimens. In Fig.7 the elongation (δ, %) of untreated (curve 1) and treated (curve 2) test pieces is plotted against the test temperature. It was found also that no significant improvement in ductility can be achieved by cooling the metal (during the treatment described above) to temperatures lower than 77 °K. An increase in

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22966

S/126/61/011/005/014/015

Plasticity and brittleness of cast ... E193/E183

the low-temperature ductility of iron, subjected to similar treatment, has been attributed (Ref.1: Gindin, I.A., FMM, 1960, 9, 447) to the formation of twins with dislocation-free boundaries. In the case of molybdenum, the present authors postulate, the increased ductility attained by this treatment is associated mainly with the stress-dependence of the temperature coefficient of linear expansion and with the changes in the mosaic structure of the metal subjected to stresses at low temperatures.

There are 8 figures and 8 references: 6 Soviet and 2 non-Soviet. The English language reference reads as follows:

Ref.6: J.H. Bechtold, J. Metals, 1953, 5, 1469.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR (Physico-technical Institute, AS Ukr.SSR)

SUBMITTED: August 15, 1960

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"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R000515110016-1
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18 8200 2808, 2208, 1418, 1416 25923

S/126/61/012/001/015/020
E193/E480

AUTHORS: Gindin, I.A., Staradubov, Ya.D., Vasyutinskiy, B.M.

TITLE: Metallographic investigation of molybdenum deformed in tension at 4.2 to 700°K. II

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.12, No.1, pp.132-139

TEXT: Many of the metals with body-centred cubic lattice undergo a ductile-to-brittle transition at sub-zero temperatures. It is to be expected that as the temperature of this transition is approached changes occur not only in the mechanical properties of the metal but also in its microstructure. Since no study of molybdenum at temperatures lower than 77°C had been reported, the investigation, the results of which are described in the present paper, was undertaken with the object of studying the microstructure of molybdenum deformed in tension at 4.2 to 700°K. Both optical and electron microscopes were used in the examination of the specimens. No etching was used, the changes in the microstructure on the preliminarily polished specimen surface having been revealed with the aid of a microinterferometer. Qualitative assessment was made of the density of slip bands, degree of uniformity of deformation

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in different grains, mean magnitude of absolute displacement in slip, and the dependence of these characteristics on the temperature and degree of plastic deformation was evaluated. The results can be summarized as follows. (1) At all temperatures at which molybdenum remains plastic (that is down to 183°K) it deforms plastically by the mechanism of slip. As in other body-centred cubic metals, branched slip lines are formed on molybdenum, indicating a more complex mechanism of deformation than that obtaining in face-centred cubic metals. This shape of the slip lines can be observed already in the early stages of plastic deformation corresponding to an elongation of $\delta = 1 - 2\%$. The effect becomes more pronounced with increasing degree of deformation at any given temperature but the effect of heavy deformation is most pronounced near the ductile-to-brittle transition temperature. Fig.2 shows (magnified 330-fold) the microstructure (a) and the interference pattern (b) of the slip bands formed on molybdenum deformed at 200°K to $\delta = 0.8\%$; the magnitude of the absolute slip was in this case approx 0.25 μ. In suitably oriented grains (particularly at high temperatures) a